



Huntington Power Plant

6 miles west of Huntington, Utah on Hwy. 31
P.O. Box 680
Huntington, Utah 84528

February 22, 2017

Mr. Bryce Bird, Director
Utah Department of Environmental Quality
Division of Air Quality
195 North 1950 West
P.O. Box 144820
Salt Lake City, UT 84114-4820

**RE: 1st Quarter, 2017 Particulate Matter Compliance Test Report - 40 CFR 63 SubPart UUUUU,
Huntington Power Plant Unit 1 and Unit 2 (Title V Permit #1501001004)**

Dear Mr. Bird,

In accordance with Title V Permit Condition II.B.3.f.1(b) and 40 CFR §63.10021(d) the Huntington Power Plant submits these 1st Quarter 2017 Particulate Matter (PM) Compliance Test Reports for Unit 1 and Unit 2. 40 CFR §63.10031(f)(6) requires the submittal of compliance test results that were generated prior to April 16, 2017. This submittal is intended to satisfy the report submittal for Huntington Unit 1 and Unit 2, and includes the portable document format (PDF) report that is submitted electronically via the Emissions Collection and Monitoring Plan System (ECMPS).

The summary results of the 1st Quarter 2017 PM test results are:

Unit	Emission rate (lb/mmBtu)
1	0.006
2	0.006

I am authorized to make this submission on behalf of the owners and operators of the affected source or affected units for which the submission is made. I certify under penalty of law that I have personally examined, and am familiar with, the statements and information submitted in this document and all its attachments. Based on my inquiry of those individuals with primary responsibility for obtaining the information, I certify that the statements and information are to the best of my knowledge and belief true, accurate, and complete. I am aware that there are significant penalties for submitting false statements and information, or omitting statements and information, including the possibility of fine or imprisonment.

Should you have any questions regarding this information, please contact Richard Neilson, Huntington Power Plant Environmental Engineer at (435) 687-4334 or me at (435) 687-4211.

Sincerely,

Darrell Cunningham
Managing Director and Responsible Official, Huntington Plant

Enclosures: Emissions Testing Report for PacifiCorp Huntington Unit 1 – Particulate Matter Compliance Testing
Emissions Testing Report for PacifiCorp Huntington Unit 2 – Particulate Matter Compliance Testing

cc: David Barnhisel
Steve Jensen
Michael Stovern, USEPA Region VIII, w/enclosures, by electronic communication



Emissions Testing Report for PacifiCorp
Huntington Unit 1
Huntington, Utah

Particulate Matter Compliance Testing

40 CFR Part 63, Subpart UUUUU

Test Date: February 7, 2017

Project Code PC17-0001.3

5160 Parfet Street
Suite A3
Wheat Ridge, CO 80033



Office (303) 495-3936
Toll Free (800) 984-9883
Fax (888) 605-0243
www.stacktest.us

Certification Statement

I certify that all field data were acquired under my direction in accordance with a system designed to assure data quality. Based on reasonable inquiry, the information submitted is to the best of my knowledge true, accurate and complete.

A handwritten signature in black ink, appearing to read "Andrew Bruning".

Andrew Bruning
Senior Project Manager
Emissions Measurement Company

I certify that this document and all attachments were prepared under my direction in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on reasonable inquiry, the information submitted is to the best of my knowledge true, accurate and complete.

A handwritten signature in black ink, appearing to read "Matthew Parks".

Matthew Parks
Technical Director
Emissions Measurement Company

Executive Summary

EMCo was contracted by PacifiCorp to conduct compliance testing at the Huntington Power Plant near Huntington, Utah. Testing was performed to determine emission rates of particulate matter (PM) from the exhaust stack of Huntington Unit 1. Compliance test results are summarized in the table below; detailed test results are given in the following report.

PaciCorp Huntington Power Plant PM Compliance Test Results Summary						
Source	Parameter	Date	Average Value	Emission Limit		
Huntington Unit 1	Filterable Particulate Matter	2/7/2017	0.006	0.030 lb/mmBtu		
			0.07	0.30 lb/MW-hr		
Each result is the average of three two-hour test runs.						
<u>Abbreviations:</u> lb/mmBtu: pounds per million British thermal units lb/MW-hr: pounds per megawatt hour						

Introduction

EMCo was contracted by PacifiCorp to conduct source testing services at the Huntington Power Plant near Huntington, Utah. The Huntington Plant comprises two pulverized coal-fired boilers. Huntington Unit #1 is equipped with low-NO_x burners and overfire air for nitrogen oxides (NO_x) control, a flue gas desulfurization (FGD) scrubber for sulfur dioxide (SO₂) control and pulse-jet fabric filters for particulate matter (PM) control. Testing was conducted in accordance with the requirements of 40 CFR Part 63 Subpart UUUUU, National Emission Standards for Hazardous Air Pollutants (NESHAP): Coal- and Oil-Fired Electric Utility Steam Generating Units.

Contact information for the project is listed in the table below.

Contact	Affiliation	Telephone	E-mail
Frank Zampedri Environmental Analyst	PacifiCorp	(801) 220-2169	frank.zampedri@pacificorp.com
Richard Neilson Environmental Engineer		(435) 687-4334	richard.neilson@pacificorp.com
Rob Leishman Environmental Scientist	UDEQ	(801) 536-4438	rleishman@utah.gov
Andrew Bruning Senior Project Manager	EMCo	(303) 810-2168	abruning@stacktest.us

Scope of Work

Testing was performed to determine concentrations and mass emission rates of particulate matter (PM) for comparison to the applicable emission limits listed in the table below.

Source	Regulation	Parameter	Emission Limit
Huntington Unit 1	NESHAP UUUUU	PM (lb/mmBtu)	0.030 lb/mmBtu
		PM (lb/MW-hr)	0.30 lb/MW-hr
Abbreviations: lb/mmBtu: pounds per million British thermal units lb/MW-hr: pounds per megawatt-hour			

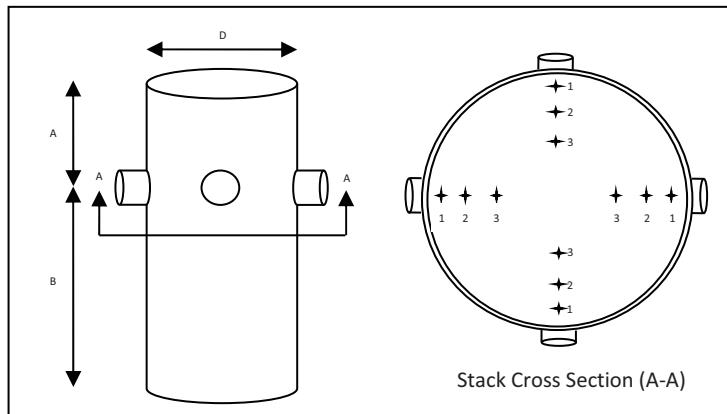
Testing Methods

EMCo used the following EPA Reference Methods for the testing program. No deviations from the Reference Methods were noted.

Parameter	EPA Reference Methods	Test Runs/Duration	Target Sample Volume
PM (lb/mmBtu)	1, 2, 3B, 4, 5*, 19	3 @ 2 hr	2 dscm (70.63 dscf)**
*In accordance with Table 5 of NESHAP Subpart UUUUU, the front-half temperature was set at 320° ± 25°F.			
**Sample volume from Table 2 of NESHAP Subpart UUUUU, doubled in accordance with §63.10005.			

Testing Location

The Huntington Unit #1 exhaust sampling location consists of a vertical, circular stack with four orthogonal sampling ports located at least six diameters downstream and two diameters upstream of the nearest flow disturbances. PM testing was performed across a grid of 12 points determined using EPA Method 1. See the schematic below.



Huntington Test Diagram	
Unit #	1
Diameter (D)	323.3"
Upstream Distance (A)	>220'
Downstream Distance (B)	>266'
Sample Point Distances from Stack Wall	
Traverse Point 1	14.1"
Traverse Point 2	47.3"
Traverse Point 3	95.7"

Test Results

The results of the testing program are given in the tables below. Detailed test results are located in Appendix A, along with sample calculations for all computed values.

PacificCorp Huntington Unit 1 PM Compliance Test Results Summary (2/7/2017)						
Parameter	Run #1	Run #2	Run #3	Average	QA Specification	Emission Limit***
Start Time	7:03	9:45	12:19	—	—	—
Stop Time	9:18	12:00	14:37	—	—	—
Sample Gas Volume (dscf)	70.99	71.71	72.03	71.58	>70.63*	—
Isokinetic Variation (%)	96.8	98.7	98.6	98.1	100 ± 10%	—
Filterable PM (lb/mmBtu)	0.008	0.005	0.006	0.006	—	0.030
Boiler Load (MW)	475	471	470	472	>468**	—
Filterable PM (lb/MW-hr)	0.08	0.05	0.06	0.07	—	0.30

* Sample volume from Table 2 of NESHAP Subpart UUUUUU, doubled in accordance with §63.10005.
**90% of design capacity, in accordance with §63.10007(a)(2).
***As shown, average PM emissions were less than 50% of the applicable emission limit, qualifying the unit for Low Emitting EGU (LEE) status.

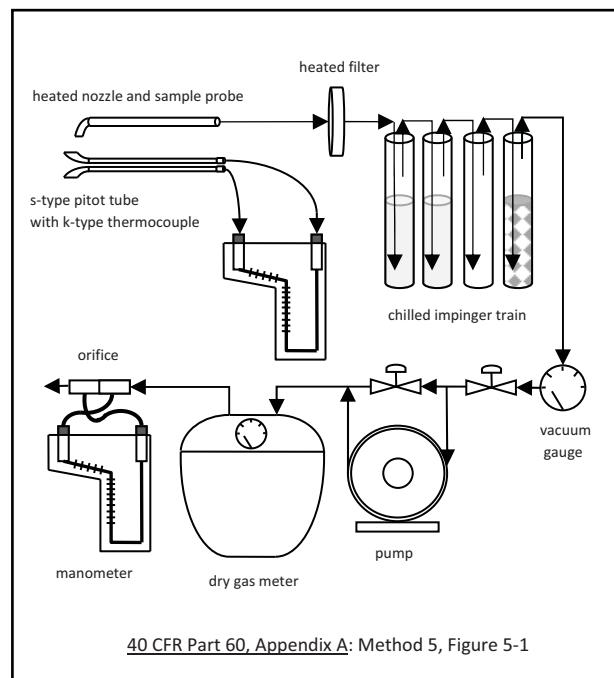
Testing Equipment

All testing equipment was housed in a climate-controlled mobile analytical laboratory designed and built by EMCo. All required quality assurance tests were performed as required by the applicable Reference Methods. Detailed equipment descriptions are given in the table below.

Parameter	Equipment	EPA Reference Method(s)
Particulate Matter (PM)	Heated probe with glass nozzle and stainless steel probe liner Quartz fiber filter S-type pitot tube K-type thermocouple Inclined-vertical manometer Dry gas meter Digital scale Analytical balance	1, 2, 3B, 4, 5, 19

Test Details

Particulate matter testing was performed using EPA Methods 1, 2, 3B, 4 and 5. Each test run was 120 minutes in duration. Sampling was performed along a grid of points determined using EPA Method 1. Exhaust gas flow measurements were taken using an S-type pitot tube, K-type thermocouple and inclined-vertical manometer in accordance with EPA Method 2. A sample of exhaust gas was withdrawn from the stack at an isokinetic flow rate through a heated stainless steel nozzle and probe, through a heated quartz-fiber filter, through four chilled glass impingers containing known masses of water or silica gel, and through a dry gas meter. (See Figure 5-1 at right.) The default dry molecular weight for combustion sources (30 lbs/lb-mole) listed in EPA Method 3 was combined with pressure and temperature measurements to calculate stack gas velocity in accordance with EPA Method 2. Stack gas moisture concentrations were determined gravimetrically in accordance with EPA Method 4. Following each sampling period, the filter and rinses of the nozzle and probe were recovered and returned to EMCo's laboratory for gravimetric analysis. Following analysis, the particulate mass captured during each test run was combined with concurrent flow and moisture data to calculate particulate matter emissions in units of pounds per hour (lb/hr). The particulate mass captured during each test run was combined with concurrent CO₂ concentration data from the plant CEMS¹ and the appropriate fuel F-factor from EPA Method 19 (1,800 scf/mmBtu) to calculate PM emissions in units of pounds per million British thermal units (lb/mmBtu) for comparison to the applicable emission limit.



¹ EPA Method 3B §6.0 states "As an alternative to the sampling apparatus and systems described herein, other sampling systems may be used, provided such systems are ... capable of yielding acceptable results." As NESHAP UUUUUU requires certified Part 75 CEMS CO₂ data to calculate SO₂ and mercury emissions in units of lb/mmBtu, CEMS CO₂ data are considered acceptable for PM emission calculations as well.

Appended Information

Supporting data for this testing program are included as follows.

Appendix A: Test Summary

- Data Reduction Spreadsheet
- Sample Calculations

Appendix B: Field Data

- Field Datasheets

Appendix C: Laboratory Data

- Gravimetric Analysis

Appendix D: CEMS Data

- Test Run CEMS Printouts

Appendix E: Calibration Information

- Dry Gas Meter Pre-Test and Post-Test Calibrations
- Critical Orifice Calibration Certificate
- AETB Certification



Project PC17-0001

Appendix A: Test Summary

Data Reduction Spreadsheets

Sample Calculations

Θ	Run #	1	2	3
	Start Time	7:03	9:45	12:19
	Stop Time	9:18	12:00	14:37
	Sample Time (min.)	120	120	120

EPA Method 2 Data		1	2	3	Average
Inputs					
D _s	Stack Diameter (inches)	323.3	323.3	323.3	323.3
P _{bar}	Barometric Pressure ("Hg)	23.48	23.42	23.42	23.44
P _g	Stack Static Pressure ("H ₂ O)	-2.5	-2.4	-2.4	-2.4
C _p	Pitot Tube Coefficient (unitless)	0.84	0.84	0.84	0.84
vΔp _{avg}	Avg. Velocity Head of Stack Gas v("H ₂ O)	0.8094	0.8045	0.8103	0.8081
T _s	Stack Gas Temperature (°F)	110	111	111	111
Calculations					
A	Stack Area (ft ²)	570.084	570.084	570.084	570.084
P _g	Stack Static Pressure ("Hg)	-0.18	-0.18	-0.18	-0.18
M _d	Stack Gas Molecular Weight, dry basis (lb/lb-mole)	30.00	30.00	30.00	30.00
M _s	Stack Gas Molecular Weight, wet basis (lb/lb-mole)	28.66	28.64	28.62	28.64
P _s	Absolute Stack Pressure ("Hg)	23.30	23.24	23.24	23.26
T _{s(abs)}	Absolute Stack Gas Temperature (°R)	570	571	571	571
V _s	Stack Gas Velocity (ft/sec)	53.7	53.5	53.9	53.7
Q	Stack Gas Dry Volumetric Flow Rate (dscf/hr)	70,631,018	69,955,171	70,339,918	70,308,702
Q	Stack Gas Dry Volumetric Flow Rate (dscf/min)	1,177,184	1,165,920	1,172,332	1,171,812

CEMS Diluent Data		1	2	3	Average
CO ₂ (%v/v)		10.9	10.9	10.8	10.9
CO ₂ (%vd)		12.3	12.3	12.2	12.3

EPA Method 4 Data		1	2	3	Average
Inputs					
V _{lc}	Volume of Water Condensed (mL)	195.1	194.4	207.2	198.9
V _m	Volume of Stack Gas Collected (dcf)	88.841	92.066	92.268	91.058
Y	Meter Calibration Factor (unitless)	0.9868	0.9868	0.9868	0.9868
ΔH	Pressure Differential Across Orifice ("H ₂ O)	1.6	1.6	1.7	1.6
T _m	Temperature at Gas Meter (°F)	54	66	65	62
Calculations					
P _m	Absolute Pressure at Gas Meter ("Hg)	23.59	23.54	23.55	23.56
T _m	Absolute Temperature at Gas Meter (°R)	514	526	525	521.7
V _{wc(std)}	Volume of Water Condensed (scf)	9.18	9.15	9.75	9.36
V _{m(std)}	Sample Gas Volume (dscf)	70.99	71.71	72.03	71.58
B _{ws act}	Observed Stack Gas Moisture Content (%/100)	0.115	0.113	0.119	0.116
B _{ws sat}	Saturated Moisture Content (%/100)	0.111	0.115	0.115	0.114
B _{ws}	Moisture Content Used (%/100)	0.111	0.113	0.115	0.113

EPA Method 5 Data		1	2	3	Average
Inputs					
D _n	Nozzle diameter (")	0.233	0.233	0.233	0.233
C1	Mass of PM collected on filter (mg)	7.8	5.2	6.6	6.5
C2	Mass of PM collected in rinses (mg)	9.7	6.4	7.3	7.8
Emission Calculations					
F _c	Fuel F-Factor (scf/mmBtu)	1800	1800	1800	1800
A _n	Cross-sectional area of nozzle (ft ²)	2.96E-04	2.96E-04	2.96E-04	2.96E-04
I	Isokinetic variation (%)	96.8	98.7	98.6	98.1
m _n	Total Filterable PM mass less blank (mg)	17.5	11.6	13.9	14.3
C _s	Filterable Particulate concentration (gr/dscf)	0.004	0.002	0.003	0.003
C _s	Filterable Particulate concentration (lb/dscf)	5.43E-07	3.57E-07	4.25E-07	4.42E-07
E _{lb/hr}	Filterable Particulate mass emission rate (lb/hr)	38	25	30	31
	Boiler Load (MW)	475	471	470	472
	Filterable Particulate mass emission rate (lb/MW-hr)	0.08	0.05	0.06	0.07
F _c	Filterable Particulate mass emission rate (lb/mmBtu)	0.008	0.005	0.006	0.006
8760 hrs/yr	Filterable Particulate mass emission rate (tons/year)	168	109	131	136

EPA Method 5: Determination of Particulate Matter Emissions (40 CFR Part 60, Appendix A-1)

Variables

Variable	Value	Definition	Unit of Measurement
D _s	323.3	Stack Diameter	inches
A	570.08	Cross-Sectional Area of the Stack	ft ²
P _g	-2.50	Stack Static Pressure	in. H ₂ O
P _g	-0.18	Stack Static Pressure	in. Hg
%CO ₂	12.3	Concentration of Carbon Dioxide	Dry Volume Percent (%vd)
M _d	30.00	Dry Molecular Weight of the Stack Gas (default)	lb/lb-mole
P _{bar}	23.48	Barometric Pressure	in. Hg
ΔH	1.55	Pressure Differential across Orifice	in. H ₂ O
P _m	23.59	Absolute Pressure at Gas Meter	in.Hg
t _m	54	Temperature at Gas Meter	°F
T _m	514	Absolute Temperature at Gas Meter	°R
K1	0.04706	Conversion Factor	ft ³ /mL
V _{lc}	195.1	Volume of Water Condensed	g
V _{wc(std)}	9.18	Volume of Water Condensed	scf
K ₄	17.64	Constant	°R/in.Hg
Y	0.9868	Meter Calibration Factor	Unitless
V _m	88.841	Volume of Stack Gas Collected	dcf
V _{m(std)}	70.987	Sample Gas Volume	dscf
B _{ws}	0.111	Stack Gas Moisture Content	%/100
M _s	28.66	Actual Molecular Weight of the Stack Gas	lb/lb-mole
P _s	23.30	Absolute Stack Pressure	in. Hg
T _s	110	Average Stack Temperature	°F
T _{s(abs)}	570	Average Absolute Stack Temperature	°R
K _p	85.49	Conversion Factor	(ft/sec) x V(((lb/lb-mole)(in.Hg))/((°R)(in.H ₂ O)))
C _p	0.84	Pitot Coefficient	Dimensionless
AvgVΔp	0.8094	Average Square Root of Velocity Head Readings	in. H ₂ O
V _s	53.70	Average Stack Gas Velocity	ft/sec
T _{std}	528	Standard Absolute Temperature	°R
P _{std}	29.92	Standard Absolute Pressure	in. Hg
Q	70,631,018	Dry Volumetric Flow Rate Corrected to Standard Conditions	dscf/hr
D _n	0.233	Nozzle Diameter	inches
A _n	2.96E-04	Cross-Sectional Area of the Nozzle	ft ²
m _n	17.50	Total PM Mass	mg
C _s	5.43E-07	Particulate Concentration	lb/dscf
E _{lb/hr}	38.4	PM Mass Emission Rate	pounds per hour
F _c	1800	F-Factor from EPA Method 19	scf/mmBtu
E _{lb/mmBtu}	0.008	PM Mass Emission Rate	pounds per million Btu
E _{tons/yr}	168.1	PM Mass Emission Rate	tons per year
K5	0.0945	Constant	(in.Hg · min) / (°R · sec)
Θ	120	Sample Time	minutes
I	96.8 %	Isokinetic variation	percent

PC17-1.3
PaciFiCorp
Huntington Unit 1
Run #1 Sample Calculations

EPA Method 5: Determination of Particulate Matter Emissions (40 CFR Part 60, Appendix A-1)

$$A = \pi(D_s/24)^2$$

$$\pi(323.3/24)^2$$

$$= 570.08 \text{ ft}^2$$

$$P_g = P_{bar}/13.6$$

$$= -2.5/13.6$$

$$= -0.18 \text{ in. Hg}$$

$$M_d = 30.00 \text{ lb/lb-mole}$$

$$P_m = P_{bar} + (\Delta H/13.6)$$

$$= 23.48 + (1.55/13.6)$$

$$= 23.59 \text{ in. Hg}$$

$$T_m = 460 + t_m$$

$$= 460 + 54$$

$$= 514 \text{ R}$$

$$V_{wc(std)} = K_1 \times V_{lc}$$

$$= 0.04706 \times 195.1$$

$$= 9.18 \text{ scf} \quad (Eq. 4-1)$$

$$V_{m(std)} = \frac{K_4 \times Y \times V_m \times P_m}{T_m}$$

$$= \frac{17.64 \times 0.9868 \times 88.841 \times 23.59}{514}$$

$$= 70.99 \text{ dscf} \quad (Eq. 4-3)$$

$$B_{ws} = \frac{V_{wc(std)}}{V_{wc(std)} + V_{m(std)}}$$

$$= \frac{9.18}{9.18 + 70.99}$$

= 0.115 (%/100) *(Eq. 4-4)* [Observed value above saturation; calculated saturation value used for subsequent calculations.]

$$M_s = M_d \times (1 - B_{ws}) + (18.0 \times B_{ws})$$

$$= 30.00 \times (1 - 0.111) + (18.0 \times 0.111)$$

$$= 28.66 \text{ lb/lb-mole} \quad (Eq. 2-6)$$

$$P_s = P_{bar} + P_g$$

$$= 23.48 + (-0.18)$$

$$= 23.30 \text{ in. Hg}$$

$$T_{s(abs)} = 460 + T_s$$

$$= 460 + 110$$

$$= 570 \text{ R}$$

PC17-1.3
PacifiCorp
Huntington Unit 1
Run #1 Sample Calculations

EPA Method 5: Determination of Particulate Matter Emissions (40 CFR Part 60, Appendix A-1)

$$V_s = K_p \times C_p \times \text{Avg}y/\Delta p \times \sqrt{\frac{T_{s(\text{abs})}}{(P_s \times M_s)}}$$

$$= 85.49 \times 0.84 \times 0.8094 \times \sqrt{\frac{570}{(23.30 \times 28.66)}}$$

$$= 53.7 \text{ ft/sec}$$

(Eq. 2-7)

$$Q = 3600 \times (1 - B_{ws}) \times (V_s) \times (A) \times \frac{(T_{\text{std}} \times P_s)}{(T_{s(\text{abs})} \times P_{\text{std}})}$$

$$= 3600 \times (1 - 0.111) \times (53.70) \times (570.08) \times \frac{(528 \times 23.30)}{(570 \times 29.92)}$$

$$= 70,631,018 \text{ dscf/hr}$$

(Eq. 2-8)

$$A_n = \pi(D_n/24)^2$$

$$\pi(0.233/24)^2$$

$$= 2.96E-04 \text{ ft}^2$$

$$C_s = \frac{m_n}{(\text{mg/g}) (\text{g/lb}) (V_{m(\text{std})})}$$

$$= \frac{17.5}{(1000) (453.592) (70.987)}$$

$$= 5.43E-07 \text{ lb/dscf}$$

$$E_{lb/hr} = C_s \times Q$$

$$= 5.43E-07 \times 70631018$$

$$= 38.4 \text{ lb/hr}$$

$$E_{lb/mmBtu} = \frac{C_s \times F_c \times 100}{(\text{CO}_2\% \text{vd})}$$

$$= \frac{5.43E-07 \times 1800 \times 100}{(12.3)}$$

$$= 0.008 \text{ lb/mmBtu}$$

$$E_{tons/yr} = \frac{E_{lb/hr} \times (\text{Hrs/yr})}{(\text{lbs/ton})}$$

$$= \frac{38.39 \times 8,760}{2000}$$

$$= 168.1 \text{ tons/year}$$

$$I = \frac{K5 \times T_{s(\text{abs})} \times V_{m(\text{std})} \times 100}{P_{s(\text{abs})} \times V_s \times A_n \times \Theta \times (1 - B_{ws})}$$

$$= \frac{0.0945 \times 570 \times 70.987 \times 100}{23.30 \times 53.70 \times 3.0E-04 \times 120 \times (1 - 0.111)}$$

$$= 96.8 \%$$

(Eq. 5-7)



Project PC17-0001
Appendix B: Field Data
Field Datasheets

Emissions Measurement Company: Method 5/202 Data Sheet

EMCo Job #:	045-AQS-127698	Operator(s):	AB/CIJ
Client:	Pacificorp	Barometric pressure ("Hg):	23.48
Source:	HTG UTRI	Static pressure ("H ₂ O):	-2.5
Date:	2-7-17	Leak Check ("H ₂ O @ Vac):	0.02@12''
Run #	1	Leak Check ("H ₂ O @ Vac):	0.02@13''
Meterbox ID:	M5 - 3	Pitot ID / Coeff:	89
Meterbox Y = .9869 H@ = 18		Pitot Leak Check:	✓
O ₂ %:	6.5	Nozzle Diameter:	0.233
CO ₂ %:	12	K Factor:	2.33 2.37
Start Time	0703	Stop Time	918

Impinger Weights (x.x g)	Initial	Final
Impinger 1		
Impinger 2		
Impinger 3		
Impinger 4 (SG)		
Total	775.7	970.8
Total		195.1

Traverse Point	Sample Time	Stack Temp (°F)	Probe Temp (°F)	Filter Temp (°F)	Velocity ΔP ("H ₂ O)	Orifice Pressure ΔH ("H ₂ O)	Vacuum (°Hg)	Sample Volume (ft ³)	DGM Temp (°F) Inlet	CPM Filter Temp (°F) Outlet	Imp. Outlet Temp (°F)
								747.949			
1	10	110	320	321	0.60	1.4	4	755.0	44	45	N/A 38
2	20	109	318	320	0.68	1.6	9	762.4	46	48	41
3	30	111	317	320	0.70	1.6	4	769.9	48	48	50
2-1	40	110	312	319	0.60	1.4	4	777.1	50	51	56
2	50	110	309	322	0.65	1.5	4	784.3	52	52	57
3	60	111	310	322	0.71	1.7	5	792.0	54	52	61
								5			
3-1	70	109	310	318	0.58	1.4	4	799.2	55	53	55
2	80	110	311	319	0.63	1.5	5	806.5	56	53	49
3	90	110	313	322	0.70	1.7	5	814.3	58	55	47
4-1	100	110	312	321	0.66	1.6	5	821.8	59	58	46
2	110	110	310	320	0.65	1.5	5	829.0	63	61	44
3	120	110	309	321	0.70	1.7	5	836.7	64	62	43
1/2	120	(110)	309	318	(0.9094)	(1.55)	5	88.841	(54)		61
Total	Total	Average	Minimum	Minimum	Avg ΔP	Average	Max.	Total	Average	Average	Maximum

Emissions Measurement Company: Method 5 Data Sheet

EMCo Job #:	045-AQS-127698	Operator(s):	Cla
Client:	Pacificorp	Barometric pressure ("Hg):	23.38 23.42
Source:	HTG U1	Static pressure ("H ₂ O):	-2.4
Date:	2-7-17	Leak Check ("H ₂ O @ Vac):	0.00 @ 10"
Run #	2	Leak Check ("H ₂ O @ Vac):	0.00 @ 12"
Meterbox ID:	M5-3	Pitot ID / Coeff:	1.84
Meterbox Y =	9868	ΔH@=	1.8
O ₂ %:	6.5	Nozzle Diameter:	233
CO ₂ %:	12	K Factor:	2.38 2.45 2.5
Start Time	0945	Stop Time	1200

Impinger Weights (x.x g)		Initial	Final
Impinger 1			
Impinger 2			
Impinger 3			
Impinger 4 (SG)			
Total	1663.6	858.0	
		Total	194.4

Filter ID:

Tin ID:

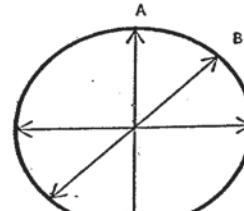
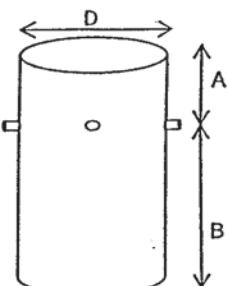
Traverse Point	Sample Time	Stack Temp (°F)	Probe Temp (°F)	Filter Temp (°F)	Velocity Δp ("H ₂ O)	Orifice Pressure ΔH ("H ₂ O)	Vacuum ("Hg)	Sample Volume (ft ³)	DGM Temp (°F) Inlet	DGM Temp (°F) Outlet	Imp. Outlet Temp (°F)
								847.283			
(1)	10	111	319	321	.57	1.4	3	854.4	66	63	40
2	20	111	320	321	.64	1.5	3	861.7	69	61	41
3	30	110	319	320	.70	1.7	4	869.5	70	61	43
(2)	40	111	320	321	.56	1.4	3	877.2	69	61	42
2	50	110	319	321	.65	1.6	3	884.7	69	62	43
3	60	111	318	320	.71	1.8	4	892.8	70	63	45
(3)	70	110	320	318	.59	1.5	3	900.4	69	62	42
2	80	111	320	320	.68	1.7	4	908.2	70	62	43
3	90	110	321	319	.70	1.8	4	916.1	68	62	43
(4)	100	110	320	321	.60	1.5	3	923.5	69	62	41
2	110	111	320	320	.68	1.7	4	931.3	70	62	41
3	120	110	318	320	.70	1.8	4	939.349	71	62	42
				318							
12	120	111	318	320	8045	1.6	4	92.0660	68	66	45
Total	Total	Average	Minimum	Minimum	Avg VΔp	Average	Max.	Total	Average	Maximum	

Stack Schematic

Stack Diameter (D)=

Distance A=

Distance B=



Nozzle Calibration

A=

B=

C=

Average =

Max Difference =

(Must be < 0.004 in.)

Emissions Measurement Company: Method 5 Data Sheet

EMCo Job #: 045-AQ25-127698
 Client: Pacificorp
 Source: HTG U1
 Date: 2-7-17
 Run #: 3
 Meterbox ID: MS-3
 Meterbox Y = 9868 ΔH@= 1.8
 O₂%: 6.5
 CO₂%: 12
 Start Time 1219

Operator(s): CW
 Barometric pressure ("Hg): 23.42
 Static pressure ("H₂O): -2.4
 Leak Check ("H₂O @ Vac): 0.00 @ 11"
 Leak Check ("H₂O @ Vac): 0.00 @ 13"
 Pitot ID / Coeff: 1.84
 Pitot Leak Check:
 Nozzle Diameter: .233
 K Factor: 2.5
 Stop Time 1437

Impinger Weights (x.x g)	Initial	Final
Impinger 1		
Impinger 2		
Impinger 3		
Impinger 4 (SG)		
Total	746.7	953.9
	Total	207.2

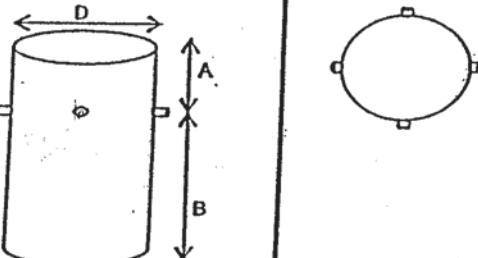
Traverse Point	Sample Time	Stack Temp (°F)	Probe Temp (°F)	Filter Temp (°F)	Velocity ΔP ("H ₂ O)	Orifice Pressure ΔH ("H ₂ O)	Vacuum ("Hg)	Sample Volume (ft ³)	DGM Temp (°F)		Imp. Outlet Temp (°F)
									Inlet	Outlet	
								939.450			
(1)	1 10	111	320	321	.60	1.5	4	946.8	65	61	40
	2 20	111	318	320	.68	1.7	4	954.6	68	61	51
	3 30	111	319	321	.71	1.8	5	962.5	69	61	52
(2)	1 40	111	321	320	.59	1.5	4	970.0	68	61	49
	2 50	111	319	319	.69	1.7	4	977.8	69	61	49
	3 60	111	321	320	.72	1.8	5	985.7	70	61	50
(3)	1 70	111	322	320	.61	1.5	4	993.3	69	62	49
	2 80	111	320	321	.66	1.7	4	001.2	69	62	50
	3 90	111	320	320	.70	1.8	5	009.2	71	62	53
(4)	1 100	111	320	320	.58	1.5	4	016.5	68	62	47
	2 110	111	321	318	.65	1.6	4	024.1	70	62	49
	3 120	112	320	319	.70	1.8	5	031.718	71	63	51
12	120	(111)	318	318	-8103	(1.7)	5	92.2680	(65)	Average	53
Total	Total	Average	Minimum	Minimum	Avg Vap	Average	Max.	Total	Total	Maximum	

Stack Schematic

Stack Diameter (D)=

Distance A=

Distance B=



Point #	Dist. From Stack Wall
1	
2	
3	
4	
5	
6	
7	
8	



Project PC17-0001
Appendix C: Lab Data
Gravimetric Analysis

Project Code:	PC17-1.3
Date Finalized:	2/16/2017
Analyst:	Parks

Laboratory Results Summary	
Sample ID	Filterable Particulate Matter (mg)
Huntington Unit 1, Run #1	17.5
Huntington Unit 1, Run #2	11.6
Huntington Unit 1, Run #3	13.9
No blank corrections were performed.	

Analytical Narrative

Quartz fiber filters were dessicated and tared to a constant weight in the EMCo laboratory prior to sampling. Following testing, the filters were dessicated for at least 24 hours, then weighed to a constant weight (± 0.5 mg). The acetone rinses were measured to the nearest milliliter, transferred to tared aluminum weighing dishes, taken to dryness under a fume hood, then weighed to a constant weight (± 0.5 mg). Each result above represents total filterable particulate matter for each test run (acetone rinse + filter catch), with no blank correction performed unless otherwise indicated.

Instrumentation

All measurements were taken using a Torbal Model AGCN200 Analytical Balance under laboratory conditions. The instrument is auto-calibrated and challenged with three NIST-traceable reference weights daily.

Detection Limit / Sensitivity

All measurements are recorded to 0.0001g (0.1mg).

Notes

No deviations from the analytical procedure from EPA Method 5 were noted. All samples were received in good condition. After analysis, all samples are archived for a period of one year.

Attachments

Gravimetric Analysis Logs

Sample Chain of Custody



EPA Method 5 Gravimetric Analysis Log

Project Code: PC17-1.3
Unit ID: Huntington Unit 1

Front-Half Particulate Matter Filter Catch

Filter #	Run #1		Run #2		Run #3	
	Date	Weight (g)	Date	Weight (g)	Date	Weight (g)
Final Weight	2/14/17	0.3918	2/14/17	0.386	2/14/17	0.3887
Tare Weight (g)	1/19/17	0.384	1/19/17	0.3808	1/19/17	0.3821
Filter Catch (g)		0.0078		0.0052		0.0066

Front-Half Particulate Matter Acetone Rinse Catch

Dish #	Run #1		Run #2		Run #3		Blank	
	Date	Weight (g)						
Final Weight	2/13/17	6.5566	2/13/17	6.579	2/13/17	6.577	2/13/17	6.6080
Tare Weight (g)	1/11/17	6.5469	1/11/17	6.5726	1/11/17	6.5697	1/11/17	6.6084
Total Rinse Catch (g)		0.0097		0.0064		0.0073		-0.0004

Total Particulate Catch

	Run #1	Run #2	Run #3
Filter Catch (g)	0.0078	0.0052	0.0066
+ Rinse Catch (g)	0.0097	0.0064	0.0073
- Acetone Blank (g)	0.0000	0.0000	0.0000
Total PM (g)	0.0175	0.0116	0.0139

Laboratory Chain of Custody Record

Project Code:							
Client:	Parifcorp						
Facility:	Huntington						
Unit:	1 + 2						
Sample Date(s):	2-7(U1) 2-8(U2)						
Project Manager:	Bruning						
Sample ID / Run #	Filter ID	Front ½ Acetone		Back ½ Hexane		Back ½ Water	
		Tin ID	Volume (mL)	Tin ID	Volume (mL)	Baggie ID	Volume (mL)
U1 R1	1261	1837		N/A		N/A	
U1 R2	1262	1829		1		1	
U1 R3	1263	1830		1		1	
U2 R1	1278	1846		1		1	
U2 R2	1137	1848		1		1	
U2 R3	1138	1847		1		1	
Blank		1836					
Relinquished by:	<u>HB</u>			Date: <u>2/9</u>			
Received by:	<u>MWP</u>			Date <u>2/9</u>			



Project PC17-0001
Appendix D: CEMS Data
CEMS Printouts for Test Runs

Average Data

Plant: HUNTINGTON PLANT

Interval: 1 Minute

Type: Block

Report Period: 02/07/2017 07:03 Through 02/07/2017 09:18

Time Online Criteria: 1 minute(s)

Source Parameter Unit	UNIT1				
	BARPRESS (INHG)	CO2 (PCT)	OPACITY (PCT)	STKTEMP (DEG F)	UNITLOAD (MW)
02/07/17 07:03	23.484	10.9	3.3	101.91	476
02/07/17 07:04	23.484	10.9	3.3	102.13	475
02/07/17 07:05	23.484	11.0	3.3	102.40	474
02/07/17 07:06	23.484	10.9	3.3	102.88	473
02/07/17 07:07	23.484	10.8	3.3	103.09	472
02/07/17 07:08	23.485	10.8	3.2	102.57	471
02/07/17 07:09	23.484	10.9	3.3	102.50	471
02/07/17 07:10	23.483	10.8	3.3	102.23	472
02/07/17 07:11	23.482	11.0	2.5 I	101.89	473
02/07/17 07:12	23.482	11.0	3.3	101.63	474
02/07/17 07:13	23.482	11.0	3.3	101.79	478
02/07/17 07:14	23.482	11.1	3.3	101.50	481
02/07/17 07:15	23.483	11.1	3.2	101.93	481
02/07/17 07:16	23.483	11.0	3.3	103.20	479
02/07/17 07:17	23.484	10.8	3.3	104.14	477
02/07/17 07:18	23.484	10.9	3.2	104.53	474
02/07/17 07:19	23.486	10.8	3.2	104.55	471
02/07/17 07:20	23.486	10.8	3.2	103.32	472
02/07/17 07:21	23.488	10.8	3.2	103.96	472
02/07/17 07:22	23.490	10.9	3.2	103.85	473
02/07/17 07:23	23.491	11.0	3.2	103.57	474
02/07/17 07:24	23.492	11.0	3.2	103.83	475
02/07/17 07:25	23.492	11.0	3.2	103.96	477
02/07/17 07:26	23.491	11.0	3.2	103.75	477
02/07/17 07:27	23.491	11.0	3.2	103.68	478
02/07/17 07:28	23.491	11.0	3.2	103.67	477
02/07/17 07:29	23.490	11.0	3.2	103.69	477
02/07/17 07:30	23.489	11.0	3.2	103.92	476
02/07/17 07:31	23.488	11.0	3.2	104.19	476
02/07/17 07:32	23.487	10.9	3.2	104.91	475
02/07/17 07:33	23.487	10.8	3.2	105.18	475
02/07/17 07:34	23.487	10.9	3.2	104.70	474
02/07/17 07:35	23.487	10.9	3.2	104.46	474
02/07/17 07:36	23.486	10.9	3.2	104.54	475
02/07/17 07:37	23.486	11.0	3.2	104.41	476
02/07/17 07:38	23.487	11.0	3.2	103.89	478
02/07/17 07:39	23.487	11.1	3.2	102.89	480
02/07/17 07:40	23.488	11.0	3.2	103.00	480

F = Unit Offline

E = Exceedance

M = Maintenance

T = Out Of Control

C = Calibration

S = Substituted

* = Suspect

Average Data

Plant: HUNTINGTON PLANT

Interval: 1 Minute

Type: Block

Report Period: 02/07/2017 07:03 Through 02/07/2017 09:18

Time Online Criteria: 1 minute(s)

02/07/17	07:41	23.488	11.1	3.2	103.10	481
02/07/17	07:42	23.488	11.0	3.3	103.53	479
02/07/17	07:43	23.488	10.8	3.2	104.59	475
02/07/17	07:44	23.488	10.7	3.2	105.24	472
02/07/17	07:45	23.487	10.6	3.2	105.16	469
02/07/17	07:46	23.486	10.7	3.2	104.72	469
02/07/17	07:47	23.485	10.8	3.2	104.09	470
02/07/17	07:48	23.486	10.8	3.3	103.61	473
02/07/17	07:49	23.487	11.0	3.3	102.87	476
02/07/17	07:50	23.486	11.1	3.3	102.85	479
02/07/17	07:51	23.485	11.1	3.3	103.26	481
02/07/17	07:52	23.485	10.9	3.2	103.44	479
02/07/17	07:53	23.486	10.9	3.2	103.60	477
02/07/17	07:54	23.487	10.9	3.3	104.15	474
02/07/17	07:55	23.487	10.9	3.2	103.74	473
02/07/17	07:56	23.488	10.9	3.2	103.49	472
02/07/17	07:57	23.490	10.8	3.3	103.35	472
02/07/17	07:58	23.491	10.9	3.2	102.87	473
02/07/17	07:59	23.491	11.0	3.2	102.69	474
02/07/17	08:00	23.492	10.9	3.3	102.96	473
02/07/17	08:01	23.492	6.8	3.3	103.19	474
02/07/17	08:02	23.491	8.4	3.3	102.65	474
02/07/17	08:03	23.491	11.0	3.3	102.50	474
02/07/17	08:04	23.490	11.0	3.3	102.82	475
02/07/17	08:05	23.489	11.0	3.3	102.53	477
02/07/17	08:06	23.488	10.9	3.3	102.62	477
02/07/17	08:07	23.489	10.9	3.3	103.24	478
02/07/17	08:08	23.490	10.9	3.3	103.67	477
02/07/17	08:09	23.490	10.9	3.4	103.26	476
02/07/17	08:10	23.491	10.9	3.3	103.68	475
02/07/17	08:11	23.491	10.8	3.3	104.55	474
02/07/17	08:12	23.491	10.8	3.3	104.69	473
02/07/17	08:13	23.491	10.8	3.3	104.20	472
02/07/17	08:14	23.491	10.8	3.3	104.30	471
02/07/17	08:15	23.492	10.8	3.3	104.13	472
02/07/17	08:16	23.492	10.9	3.3	103.82	473
02/07/17	08:17	23.492	11.0	3.3	103.65	473
02/07/17	08:18	23.492	11.0	3.3	103.00	475
02/07/17	08:19	23.492	11.0	3.3	103.08	476
02/07/17	08:20	23.492	11.0	3.3	103.02	477
02/07/17	08:21	23.491	10.9	3.3	103.04	477

F = Unit Offline

E = Exceedance

M = Maintenance

T = Out Of Control

C = Calibration

S = Substituted

* = Suspect

Average Data

Plant: HUNTINGTON PLANT

Interval: 1 Minute

Type: Block

Report Period: 02/07/2017 07:03 Through 02/07/2017 09:18

Time Online Criteria: 1 minute(s)

02/07/17	08:22	23.492	11.0	3.3	102.85	477
02/07/17	08:23	23.493	10.9	3.3	102.98	477
02/07/17	08:24	23.495	10.8	3.3	103.10	476
02/07/17	08:25	23.496	10.9	3.3	103.26	475
02/07/17	08:26	23.495	10.9	3.3	103.48	475
02/07/17	08:27	23.495	10.8	3.3	103.37	475
02/07/17	08:28	23.495	10.9	3.3	103.23	475
02/07/17	08:29	23.495	10.9	3.3	103.10	476
02/07/17	08:30	23.495	10.9	3.3	103.04	476
02/07/17	08:31	23.495	11.0	3.3	102.84	478
02/07/17	08:32	23.496	11.0	3.3	102.48	478
02/07/17	08:33	23.497	11.0	3.3	102.56	478
02/07/17	08:34	23.498	10.9	3.3	104.46	476
02/07/17	08:35	23.498	10.8	3.3	104.17	475
02/07/17	08:36	23.498	10.8	3.3	104.17	473
02/07/17	08:37	23.497	10.7	3.3	104.04	471
02/07/17	08:38	23.497	10.7	3.3	103.66	470
02/07/17	08:39	23.496	10.8	3.3	102.91	471
02/07/17	08:40	23.495	10.9	3.3	102.39	473
02/07/17	08:41	23.495	11.0	3.3	102.08	476
02/07/17	08:42	23.494	11.1	3.4	102.29	480
02/07/17	08:43	23.494	11.1	3.3	102.33	482
02/07/17	08:44	23.494	11.1	3.3	102.84	482
02/07/17	08:45	23.494	10.8	3.3	104.25	479
02/07/17	08:46	23.494	10.8	3.3	104.31	474
02/07/17	08:47	23.494	10.9	3.3	103.96	471
02/07/17	08:48	23.494	10.7	3.3	104.11	470
02/07/17	08:49	23.495	10.7	3.3	103.84	470
02/07/17	08:50	23.495	10.9	3.3	103.91	471
02/07/17	08:51	23.495	10.9	3.3	103.85	473
02/07/17	08:52	23.494	11.0	3.3	102.62	477
02/07/17	08:53	23.495	11.0	3.3	102.76	479
02/07/17	08:54	23.494	11.1	3.3	103.46	481
02/07/17	08:55	23.494	11.0	3.3	103.86	479
02/07/17	08:56	23.494	10.9	3.3	103.77	477
02/07/17	08:57	23.494	10.8	3.3	104.05	474
02/07/17	08:58	23.493	10.8	3.3	104.50	472
02/07/17	08:59	23.492	10.8	3.3	104.04	472
02/07/17	09:00	23.491	10.9	3.3	103.94	473
02/07/17	09:01	23.491	10.9	3.3	104.19	474
02/07/17	09:02	23.491	10.9	3.3	103.91	476

F = Unit Offline

E = Exceedance

M = Maintenance

T = Out Of Control

C = Calibration

S = Substituted

* = Suspect

Average Data

Plant: HUNTINGTON PLANT

Interval: 1 Minute

Type: Block

Report Period: 02/07/2017 07:03 Through 02/07/2017 09:18

Time Online Criteria: 1 minute(s)

02/07/17	09:03	23.491	10.9	3.3	103.76	478
02/07/17	09:04	23.491	11.0	3.3	103.56	479
02/07/17	09:05	23.491	11.1	3.3	103.68	479
02/07/17	09:06	23.492	10.9	3.3	104.07	478
02/07/17	09:07	23.493	10.9	3.3	104.28	476
02/07/17	09:08	23.493	10.8	3.3	104.42	474
02/07/17	09:09	23.492	10.9	3.3	104.70	473
02/07/17	09:10	23.492	10.8	3.3	104.73	471
02/07/17	09:11	23.492	10.7	3.3	104.83	471
02/07/17	09:12	23.493	10.8	3.3	104.70	470
02/07/17	09:13	23.493	10.8	3.3	104.14	470
02/07/17	09:14	23.494	11.0	3.3	103.43	472
02/07/17	09:15	23.494	11.0	3.3	103.38	475
02/07/17	09:16	23.494	11.0	3.3	103.54	477
02/07/17	09:17	23.494	11.1	3.3	103.90	479
02/07/17	09:18	23.495	11.0	3.3	104.91	478

Average	23.490	10.9	3.3	103.53	475
Minimum	23.482	10.6	3.2	101.50	469
Maximum	23.498	11.1	3.4	105.24	482
Summation	3,194.703	1,440.2	442.0	14,080.18	64,611

Included Data Points	136	132	135	136	136
Total number of Data Points	136	136	136	136	136

F = Unit Offline

E = Exceedance

M = Maintenance

T = Out Of Control

C = Calibration

S = Substituted

* = Suspect

Average Data

Plant: HUNTINGTON PLANT

Interval: 1 Minute

Type: Block

Report Period: 02/07/2017 09:45 Through 02/07/2017 12:00

Time Online Criteria: 1 minute(s)

Source Parameter Unit	UNIT1				
	BARPRESS (INHG)	CO2 (PCT)	OPACITY (PCT)	STKTEMP (DEG F)	UNITLOAD (MW)
02/07/17 09:45	23.490	11.1	3.3	105.67	481
02/07/17 09:46	23.491	10.9	3.3	106.31	478
02/07/17 09:47	23.491	10.8	3.3	106.46	474
02/07/17 09:48	23.491	10.7	3.3	106.36	469
02/07/17 09:49	23.492	10.7	3.3	106.44	466
02/07/17 09:50	23.491	10.6	3.3	106.40	468
02/07/17 09:51	23.492	10.8	3.3	105.64	472
02/07/17 09:52	23.491	11.1	3.3	104.91	477
02/07/17 09:53	23.492	11.1	3.3	104.53	483
02/07/17 09:54	23.492	11.2	3.3	104.69	487
02/07/17 09:55	23.492	11.0	3.3	104.88	486
02/07/17 09:56	23.490	11.0	3.3	105.79	481
02/07/17 09:57	23.489	10.8	3.3	105.81	474
02/07/17 09:58	23.489	10.7	3.3	105.68	469
02/07/17 09:59	23.488	10.7	3.3	106.00	466
02/07/17 10:00	23.489	10.7	3.3	106.26	465
02/07/17 10:01	23.490	10.8	3.3	105.85	467
02/07/17 10:02	23.491	10.9	3.3	104.64	471
02/07/17 10:03	23.492	10.9	3.3	104.33	473
02/07/17 10:04	23.491	10.9	3.3	104.79	474
02/07/17 10:05	23.491	10.9	3.3	105.21	472
02/07/17 10:06	23.490	10.8	3.3	105.20	469
02/07/17 10:07	23.490	10.8	3.4	104.99	467
02/07/17 10:08	23.491	10.8	3.3	105.21	466
02/07/17 10:09	23.491	10.8	3.3	105.43	466
02/07/17 10:10	23.491	10.8	3.3	104.89	468
02/07/17 10:11	23.490	11.0	3.3	104.36	471
02/07/17 10:12	23.488	11.1	3.4	103.84	475
02/07/17 10:13	23.487	11.1	3.4	103.80	477
02/07/17 10:14	23.487	11.1	3.3	104.33	477
02/07/17 10:15	23.487	10.9	3.4	105.56	473
02/07/17 10:16	23.488	10.6	3.4	105.94	470
02/07/17 10:17	23.489	10.7	3.4	106.14	468
02/07/17 10:18	23.490	10.7	3.4	106.33	465
02/07/17 10:19	23.490	10.7	3.4	105.57	465
02/07/17 10:20	23.489	10.7	3.4	105.06	466
02/07/17 10:21	23.489	10.9	3.4	104.84	468
02/07/17 10:22	23.488	11.0	3.4	104.08	472

F = Unit Offline

E = Exceedance

M = Maintenance

T = Out Of Control

C = Calibration

S = Substituted

* = Suspect

Average Data

Plant: HUNTINGTON PLANT

Interval: 1 Minute

Type: Block

Report Period: 02/07/2017 09:45 Through 02/07/2017 12:00

Time Online Criteria: 1 minute(s)

02/07/17	10:23	23.488	11.0	3.4	103.58	475
02/07/17	10:24	23.489	11.1	3.4	103.84	476
02/07/17	10:25	23.490	10.9	3.4	105.45	474
02/07/17	10:26	23.491	10.8	3.4	105.77	470
02/07/17	10:27	23.492	10.8	3.4	106.34	465
02/07/17	10:28	23.493	10.6	3.3	106.44	462
02/07/17	10:29	23.495	10.6	3.4	106.41	462
02/07/17	10:30	23.495	10.6	3.4	105.52	463
02/07/17	10:31	23.495	10.9	3.4	103.74	466
02/07/17	10:32	23.494	11.1	3.4	103.06	471
02/07/17	10:33	23.493	11.1	3.4	103.29	476
02/07/17	10:34	23.493	11.0	3.4	104.07	478
02/07/17	10:35	23.494	11.0	3.4	105.12	476
02/07/17	10:36	23.495	10.8	3.4	105.76	472
02/07/17	10:37	23.496	10.8	3.4	105.70	468
02/07/17	10:38	23.497	10.8	3.4	105.73	465
02/07/17	10:39	23.497	10.8	3.4	105.31	467
02/07/17	10:40	23.496	10.8	3.4	104.73	468
02/07/17	10:41	23.495	10.9	3.4	104.74	470
02/07/17	10:42	23.495	10.9	3.4	105.01	472
02/07/17	10:43	23.496	11.0	3.5	104.94	472
02/07/17	10:44	23.497	11.0	3.6	105.00	472
02/07/17	10:45	23.496	10.9	3.5	105.49	474
02/07/17	10:46	23.494	10.9	3.5	106.02	474
02/07/17	10:47	23.493	10.9	3.4	106.12	473
02/07/17	10:48	23.494	10.8	3.4	106.14	473
02/07/17	10:49	23.495	10.8	3.4	106.02	471
02/07/17	10:50	23.495	10.8	3.4	105.88	470
02/07/17	10:51	23.493	10.8	3.4	105.94	469
02/07/17	10:52	23.492	10.8	3.4	106.18	468
02/07/17	10:53	23.493	10.7	3.8	106.66	467
02/07/17	10:54	23.493	10.8	3.4	106.09	468
02/07/17	10:55	23.493	10.8	3.4	104.75	468
02/07/17	10:56	23.494	10.9	3.4	104.31	470
02/07/17	10:57	23.496	11.0	3.4	104.17	471
02/07/17	10:58	23.495	10.9	3.4	104.40	471
02/07/17	10:59	23.493	10.8	3.4	104.52	472
02/07/17	11:00	23.493	11.0	3.4	104.47	473
02/07/17	11:01	23.493	11.0	3.4	104.64	473
02/07/17	11:02	23.494	10.9	3.3	104.84	472
02/07/17	11:03	23.494	10.9	3.4	105.21	472

F = Unit Offline

E = Exceedance

M = Maintenance

T = Out Of Control

C = Calibration

S = Substituted

* = Suspect

Average Data

Plant: HUNTINGTON PLANT

Interval: 1 Minute

Type: Block

Report Period: 02/07/2017 09:45 Through 02/07/2017 12:00

Time Online Criteria: 1 minute(s)

02/07/17	11:04	23.493	10.8	3.4	105.32	470
02/07/17	11:05	23.490	10.8	3.4	105.48	468
02/07/17	11:06	23.487	10.7	3.4	104.99	466
02/07/17	11:07	23.486	10.7	3.4	104.58	463
02/07/17	11:08	23.485	10.7	3.4	104.99	464
02/07/17	11:09	23.486	10.7	3.4	105.04	465
02/07/17	11:10	23.487	10.9	3.4	104.71	469
02/07/17	11:11	23.485	11.0	3.4	104.95	472
02/07/17	11:12	23.484	10.9	3.4	105.18	475
02/07/17	11:13	23.486	10.9	3.4	105.16	474
02/07/17	11:14	23.487	10.9	3.4	105.43	472
02/07/17	11:15	23.488	10.8	3.4	105.62	470
02/07/17	11:16	23.488	10.7	3.4	105.59	467
02/07/17	11:17	23.487	10.8	3.4	105.83	466
02/07/17	11:18	23.487	10.8	3.4	106.00	467
02/07/17	11:19	23.486	10.9	3.4	105.44	468
02/07/17	11:20	23.485	10.9	3.4	105.08	470
02/07/17	11:21	23.486	10.9	3.4	104.85	473
02/07/17	11:22	23.486	10.9	3.4	104.54	474
02/07/17	11:23	23.483	10.9	3.5	104.69	474
02/07/17	11:24	23.481	10.8	3.5	104.89	472
02/07/17	11:25	23.480	10.8	3.5	105.26	471
02/07/17	11:26	23.481	10.9	3.5	105.51	470
02/07/17	11:27	23.483	10.9	3.4	104.93	470
02/07/17	11:28	23.485	11.0	3.4	104.32	472
02/07/17	11:29	23.486	11.0	3.4	104.13	473
02/07/17	11:30	23.485	10.9	3.4	104.23	474
02/07/17	11:31	23.485	10.9	3.4	104.58	473
02/07/17	11:32	23.487	10.8	3.4	105.30	471
02/07/17	11:33	23.487	10.7	3.4	105.71	468
02/07/17	11:34	23.488	10.7	3.4	105.95	465
02/07/17	11:35	23.490	10.6	3.4	106.12	464
02/07/17	11:36	23.488	10.7	3.4	105.43	465
02/07/17	11:37	23.487	10.9	3.4	104.54	467
02/07/17	11:38	23.486	10.9	3.4	104.71	471
02/07/17	11:39	23.484	11.0	3.4	104.74	473
02/07/17	11:40	23.486	10.9	3.5	104.77	474
02/07/17	11:41	23.488	10.8	3.4	104.84	473
02/07/17	11:42	23.489	10.9	3.4	104.50	471
02/07/17	11:43	23.489	10.8	3.4	104.80	469
02/07/17	11:44	23.489	10.8	3.4	105.16	468

F = Unit Offline

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T = Out Of Control

C = Calibration

S = Substituted

* = Suspect

Average Data

Plant: HUNTINGTON PLANT

Interval: 1 Minute

Type: Block

Report Period: 02/07/2017 09:45 Through 02/07/2017 12:00

Time Online Criteria: 1 minute(s)

02/07/17	11:45	23.489	10.8	3.4	105.11	466
02/07/17	11:46	23.491	10.8	3.4	105.08	467
02/07/17	11:47	23.492	10.8	3.4	104.88	468
02/07/17	11:48	23.493	10.8	3.4	104.87	468
02/07/17	11:49	23.494	10.8	3.4	104.45	469
02/07/17	11:50	23.493	11.0	3.4	103.80	471
02/07/17	11:51	23.494	11.0	3.4	103.88	473
02/07/17	11:52	23.494	11.0	3.4	103.77	473
02/07/17	11:53	23.494	11.0	3.4	103.87	473
02/07/17	11:54	23.494	10.9	3.4	104.47	472
02/07/17	11:55	23.492	10.8	3.4	104.37	471
02/07/17	11:56	23.493	10.8	3.4	105.19	470
02/07/17	11:57	23.494	10.8	3.5	105.51	469
02/07/17	11:58	23.493	10.7	3.5	104.59	468
02/07/17	11:59	23.494	10.8	3.5	103.90	468
02/07/17	12:00	23.494	10.9	3.5	103.84	469

Average	23.490	10.9	3.4	105.10	471
Minimum	23.480	10.6	3.3	103.06	462
Maximum	23.497	11.2	3.8	106.66	487
Summation	3,194.693	1,476.5	461.3	14,293.09	64,001

Included Data Points	136	136	136	136	136
Total number of Data Points	136	136	136	136	136

F = Unit Offline

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* = Suspect

Average Data

Plant: HUNTINGTON PLANT

Interval: 1 Minute

Type: Block

Report Period: 02/07/2017 12:19 Through 02/07/2017 14:37

Time Online Criteria: 1 minute(s)

Source Parameter Unit	UNIT1				
	BARPRESS (INHG)	CO2 (PCT)	OPACITY (PCT)	STKTEMP (DEG F)	UNITLOAD (MW)
02/07/17 12:19	23.494	10.7	3.5	106.00	466
02/07/17 12:20	23.496	10.9	3.5	105.42	469
02/07/17 12:21	23.495	10.9	3.5	105.32	472
02/07/17 12:22	23.493	11.0	3.5	104.55	476
02/07/17 12:23	23.492	11.0	3.5	104.23	476
02/07/17 12:24	23.492	10.9	3.5	105.03	476
02/07/17 12:25	23.492	10.9	3.4	106.18	472
02/07/17 12:26	23.492	10.8	3.4	106.23	468
02/07/17 12:27	23.492	10.7	3.4	106.53	466
02/07/17 12:28	23.492	10.8	3.4	106.42	465
02/07/17 12:29	23.494	10.7	3.5	106.42	465
02/07/17 12:30	23.493	10.7	3.5	106.22	467
02/07/17 12:31	23.493	10.8	3.5	105.99	468
02/07/17 12:32	23.492	10.9	3.5	105.87	470
02/07/17 12:33	23.492	10.9	3.5	105.39	471
02/07/17 12:34	23.493	10.9	3.4	105.23	472
02/07/17 12:35	23.493	10.9	3.5	105.53	471
02/07/17 12:36	23.493	10.9	3.5	105.54	471
02/07/17 12:37	23.493	10.9	3.5	105.39	472
02/07/17 12:38	23.492	10.9	3.4	105.26	472
02/07/17 12:39	23.492	10.9	3.4	105.08	473
02/07/17 12:40	23.490	11.0	3.4	105.54	473
02/07/17 12:41	23.491	10.9	3.4	106.22	472
02/07/17 12:42	23.491	10.8	3.4	106.75	472
02/07/17 12:43	23.490	10.9	3.5	107.00	470
02/07/17 12:44	23.489	10.8	3.5	106.76	469
02/07/17 12:45	23.491	10.8	3.4	106.70	469
02/07/17 12:46	23.492	10.8	3.4	106.81	468
02/07/17 12:47	23.492	10.8	3.4	106.56	468
02/07/17 12:48	23.493	10.8	3.5	106.18	469
02/07/17 12:49	23.493	10.9	3.4	106.07	470
02/07/17 12:50	23.493	10.9	3.4	106.22	472
02/07/17 12:51	23.493	10.8	3.4	106.39	472
02/07/17 12:52	23.491	10.9	3.4	106.28	472
02/07/17 12:53	23.490	10.8	3.4	106.62	472
02/07/17 12:54	23.489	10.7	3.4	106.72	470
02/07/17 12:55	23.489	10.7	3.4	106.79	469
02/07/17 12:56	23.488	10.7	3.4	106.92	467

F = Unit Offline

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* = Suspect

Average Data

Plant: HUNTINGTON PLANT

Interval: 1 Minute

Type: Block

Report Period: 02/07/2017 12:19 Through 02/07/2017 14:37

Time Online Criteria: 1 minute(s)

02/07/17	12:57	23.489	10.7	3.4	107.19	466
02/07/17	12:58	23.491	10.7	3.4	107.00	467
02/07/17	12:59	23.493	10.8	3.4	105.87	469
02/07/17	13:00	23.493	11.0	3.4	105.17	471
02/07/17	13:01	23.491	10.9	3.4	105.46	473
02/07/17	13:02	23.492	10.9	3.4	106.17	474
02/07/17	13:03	23.493	10.9	3.4	107.06	473
02/07/17	13:04	23.493	10.9	3.4	106.83	471
02/07/17	13:05	23.494	10.8	3.4	106.19	469
02/07/17	13:06	23.495	10.7	3.4	106.22	467
02/07/17	13:07	23.493	10.7	3.4	106.93	465
02/07/17	13:08	23.491	10.7	3.4	107.09	466
02/07/17	13:09	23.492	10.7	3.4	107.15	466
02/07/17	13:10	23.494	10.8	3.4	106.75	468
02/07/17	13:11	23.492	10.8	3.4	106.21	469
02/07/17	13:12	23.486	10.9	3.4	106.13	471
02/07/17	13:13	23.483	10.9	3.4	106.22	471
02/07/17	13:14	23.484	10.8	3.4	106.33	472
02/07/17	13:15	23.487	10.8	3.4	106.18	471
02/07/17	13:16	23.488	10.8	3.4	106.01	470
02/07/17	13:17	23.489	10.9	3.4	106.16	469
02/07/17	13:18	23.490	10.7	3.4	106.45	468
02/07/17	13:19	23.489	10.7	3.4	106.52	468
02/07/17	13:20	23.489	10.8	3.4	106.45	470
02/07/17	13:21	23.491	11.0	3.4	106.82	470
02/07/17	13:22	23.490	11.0	3.4	107.51	474
02/07/17	13:23	23.487	11.0	3.4	106.99	476
02/07/17	13:24	23.485	11.0	3.4	105.99	477
02/07/17	13:25	23.483	11.0	3.4	106.34	476
02/07/17	13:26	23.484	10.9	3.4	106.68	475
02/07/17	13:27	23.486	10.8	3.4	107.23	472
02/07/17	13:28	23.487	10.7	3.4	107.80	469
02/07/17	13:29	23.487	10.6	3.3	107.63	466
02/07/17	13:30	23.486	10.7	3.4	107.07	466
02/07/17	13:31	23.482	10.8	3.4	106.81	468
02/07/17	13:32	23.479	10.9	3.4	106.26	470
02/07/17	13:33	23.480	10.9	3.4	105.46	473
02/07/17	13:34	23.482	11.0	3.4	105.70	474
02/07/17	13:35	23.484	10.8	3.4	106.35	472
02/07/17	13:36	23.484	10.7	3.4	106.98	469
02/07/17	13:37	23.483	10.6	3.3	107.69	465

F = Unit Offline

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Average Data

Plant: HUNTINGTON PLANT

Interval: 1 Minute

Type: Block

Report Period: 02/07/2017 12:19 Through 02/07/2017 14:37

Time Online Criteria: 1 minute(s)

02/07/17	13:38	23.484	10.6	3.3	108.26	462
02/07/17	13:39	23.485	10.6	3.4	107.92	463
02/07/17	13:40	23.484	10.8	3.4	106.82	465
02/07/17	13:41	23.482	10.9	3.4	105.64	470
02/07/17	13:42	23.483	11.0	3.4	104.97	475
02/07/17	13:43	23.485	11.1	3.4	104.55	479
02/07/17	13:44	23.485	11.0	3.4	104.88	480
02/07/17	13:45	23.484	10.9	3.4	105.47	477
02/07/17	13:46	23.483	10.8	3.4	106.05	471
02/07/17	13:47	23.482	10.7	3.4	106.68	466
02/07/17	13:48	23.485	10.7	3.3	107.21	464
02/07/17	13:49	23.485	10.6	3.4	107.47	464
02/07/17	13:50	23.485	10.7	3.5	106.87	465
02/07/17	13:51	23.485	10.9	3.5	106.68	468
02/07/17	13:52	23.485	10.9	3.4	107.47	472
02/07/17	13:53	23.485	10.8	3.4	107.89	473
02/07/17	13:54	23.483	10.8	3.4	107.98	472
02/07/17	13:55	23.483	10.8	3.4	108.04	470
02/07/17	13:56	23.484	10.8	3.4	108.62	468
02/07/17	13:57	23.483	10.7	3.4	109.32	467
02/07/17	13:58	23.481	10.8	3.4	109.38	468
02/07/17	13:59	23.484	10.9	3.4	108.21	470
02/07/17	14:00	23.483	10.9	3.4	107.25	472
02/07/17	14:01	23.482	10.8	3.4	107.20	472
02/07/17	14:02	23.482	10.9	3.3	107.41	471
02/07/17	14:03	23.482	10.7	3.3	107.95	470
02/07/17	14:04	23.480	10.7	3.3	108.43	469
02/07/17	14:05	23.481	10.7	3.3	108.18	467
02/07/17	14:06	23.482	10.7	3.3	107.50	467
02/07/17	14:07	23.483	10.8	3.3	106.95	468
02/07/17	14:08	23.483	10.8	3.4	106.80	470
02/07/17	14:09	23.482	10.9	3.4	106.39	473
02/07/17	14:10	23.483	11.0	3.3	106.15	476
02/07/17	14:11	23.485	11.0	3.3	106.49	477
02/07/17	14:12	23.483	10.9	3.3	106.86	476
02/07/17	14:13	23.483	10.8	3.3	108.89	474
02/07/17	14:14	23.482	10.7	3.3	109.99	469
02/07/17	14:15	23.482	10.6	3.3	109.78	464
02/07/17	14:16	23.482	10.5	3.3	109.45	461
02/07/17	14:17	23.483	10.5	3.4	108.44	459
02/07/17	14:18	23.481	10.6	3.4	107.55	460

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Average Data

Plant: HUNTINGTON PLANT

Interval: 1 Minute

Type: Block

Report Period: 02/07/2017 12:19 Through 02/07/2017 14:37

Time Online Criteria: 1 minute(s)

02/07/17	14:19	23.479	10.6	3.5	107.82	464
02/07/17	14:20	23.481	10.8	3.4	107.83	470
02/07/17	14:21	23.484	11.1	3.5	107.90	475
02/07/17	14:22	23.484	11.0	3.5	108.71	478
02/07/17	14:23	23.485	11.0	3.4	108.68	479
02/07/17	14:24	23.484	10.9	3.3	109.05	475
02/07/17	14:25	23.482	10.6	3.3	109.90	469
02/07/17	14:26	23.482	10.5	3.3	109.94	464
02/07/17	14:27	23.481	10.5	3.3	110.10	462
02/07/17	14:28	23.482	10.5	3.3	109.82	462
02/07/17	14:29	23.483	10.7	3.3	109.02	465
02/07/17	14:30	23.484	10.8	3.3	108.61	468
02/07/17	14:31	23.484	10.9	3.3	108.26	472
02/07/17	14:32	23.485	10.9	3.3	107.60	475
02/07/17	14:33	23.486	11.0	3.3	107.44	476
02/07/17	14:34	23.486	10.9	3.3	107.54	475
02/07/17	14:35	23.489	10.9	3.3	107.26	472
02/07/17	14:36	23.488	10.9	3.3	107.34	469
02/07/17	14:37	23.488	10.7	3.3	107.74	467

Average	23.487	10.8	3.4	106.92	470
Minimum	23.479	10.5	3.3	104.23	459
Maximum	23.496	11.1	3.5	110.10	480
Summation	3,264.712	1,503.2	471.7	14,862.01	65,329

Included Data Points	139	139	139	139	139
Total number of Data Points	139	139	139	139	139

F = Unit Offline

E = Exceedance

M = Maintenance

T = Out Of Control

C = Calibration

S = Substituted

*** = Suspect**



Project PC17-0001

Appendix E: Calibration Information

Dry Gas Meter Pre-Test and Post-Test Calibrations

Critical Orifice Calibration Certificate

AETB Certification

METHOD 5 DRY GAS METER CALIBRATION USING CRITICAL ORIFICES

- 1) Select three critical orifices to calibrate the dry gas meter which bracket the expected operating range.
- 2) Record barometric pressure before and after calibration procedure.
- 3) Run at tested vacuum (from Orifice Calibration Report), for a period of time necessary to achieve a minimum total volume of 5 cubic feet.
- 4) Record data and information in the **GREEN** cells, **YELLOW** cells are calculated.



DATE:		9/21/2016	METER SERIAL #:		16025473	BAROMETRIC PRESSURE (in Hg):				INITIAL	FINAL	AVG (P _{bar})						
METER ID #:		M5-3	CRITICAL ORIFICE SET SERIAL #:		1531S					24.51	24.5	24.505						
ORIFICE #	RUN #	K' FACTOR	TESTED VACUUM	DGM READINGS (FT ³)			TEMPERATURES °F				ELAPSED TIME (MIN) θ	DGM ΔH (in H ₂ O)	(1) V _m (STD)	(2) V _{cr} (STD)	(3) Y	Y % Diff to Average Y	Y % Diff with other orifices	ΔH _@
		(AVG)	(in Hg)	INITIAL	FINAL	NET (V _m)	AMBIENT	DGM INLET	DGM OUTLET	DGM AVG								
23	1	0.6363	17	77.837	82.032	4.195	76	74	75	74	74.25	5.00	1.8	3.4145	3.3684	0.987	1.82	
	2	0.6363	17	82.032	86.225	4.193	76	75	76	74	74.75	5.00	1.8	3.4097	3.3684	0.988	1.81	
	3	0.6363	17	86.225	90.455	4.230	77	76	76	74	75.25	5.00	1.8	3.4366	3.3653	0.979	1.82	
18	1	0.5004	17.5	90.470	93.758	3.288	77	76	76	75	75.5	5.00	1.1	2.6645	2.6466	0.993	1.79	
	2	0.5004	17.5	93.758	97.052	3.294	77	76	76	75	75.5	5.00	1.1	2.6693	2.6466	0.991	1.79	
	3	0.5004	17.5	97.052	100.340	3.288	77	76	77	75	75.75	5.00	1.1	2.6632	2.6466	0.994	1.79	
12	1	0.3193	19.5	100.340	102.464	2.124	77	77	77	75	76	76.25	5.00	0.45	1.7154	1.6887	0.984	1.79
	2	0.3193	19.5	102.464	104.590	2.126	77	77	77	75	76	76.25	5.00	0.45	1.7171	1.6887	0.984	1.79
	3	0.3193	19.5	104.590	106.715	2.125	77	74	74	76	74	74.5	5.00	0.45	1.7219	1.6887	0.981	1.80
													AVG =	0.983	-0.39	-0.17		

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:

The following equations are used to calculate the standard volumes of air passed through the DGM, V_m (std), and the critical orifice, V_{cr} (std), and the DGM calibration factor, Y. These equations are automatically calculated in the spreadsheet above.

$$\text{AVERAGE DRY GAS METER CALIBRATION FACTOR, } Y = \boxed{0.9868}$$

$$\text{AVERAGE } \Delta H_{@} = \boxed{1.80}$$

$$(1) \quad V_{m(\text{std})} = K_1 * V_m * \frac{P_{\text{bar}} + (\Delta H / 13.6)}{T_m} \quad = \text{Net volume of gas sample passed through DGM, corrected to standard conditions}$$

K₁ = 17.64 °R/in. Hg (English), 0.3858 °K/mm Hg (Metric)

T_m = Absolute DGM avg. temperature (°R - English, °K - Metric)

$$\Delta H_{@} = \left(\frac{0.75 \theta}{V_{cr(\text{std})}} \right)^2 \Delta H \left(\frac{V_{m(\text{std})}}{V_m} \right)$$

$$(2) \quad V_{cr(\text{std})} = K' * \frac{P_{\text{bar}} * \theta}{\sqrt{T_{\text{amb}}}} \quad = \text{Volume of gas sample passed through the critical orifice, corrected to standard conditions}$$

T_{amb} = Absolute ambient temperature (°R - English, °K - Metric)

K' = Average K' factor from Critical Orifice Calibration

$$(3) \quad Y = \frac{V_{cr(\text{std})}}{V_{m(\text{std})}} \quad = \text{DGM calibration factor}$$

METHOD 5 DRY GAS METER CALIBRATION USING CRITICAL ORIFICES



ENVIRONMENTAL SUPPLY COMPANY

DATE:		2.9.17	METER SERIAL #:		17465146	CRITICAL ORIFICE SET SERIAL #:		1531s	BAROMETRIC PRESSURE (in Hg):		24.33	FINAL	AVG (P _{bar})						
METER ID #:		M5-3									24.33	24.33	24.33						
ORIFICE #	RUN #	K'	TESTED	VACUUM	DGM READINGS (FT ³)			TEMPERATURES °F			ELAPSED TIME (MIN)	DGM ΔH (in H ₂ O)	(1) V _m (STD)	(2) V _{cr} (STD)	(3) Y	Y % Diff to Average Y	Y % Diff with other orifices	ΔH@	
		FACTOR (AVG)	VACUUM (in Hg)		INITIAL	FINAL	NET (V _m)	AMBIENT	DGM INLET	DGM OUTLET									
23	1	0.6366	14		363.415	367.464	4.049	61	61	63	59	60	60.75	5.00	1.8	3.3572	3.3938	1.011	1.82
	2	0.6366	14		367.464	371.502	4.038	61	63	63	60	60	61.5	5.00	1.8	3.3432	3.3938	1.015	1.82
	3	0.6366	14		371.502	375.523	4.021	62	63	64	60	61	62	5.00	1.8	3.3260	3.3906	1.019	1.82
18	1	0.4976	15		379.413	383.195	3.782	62	64	64	61	62	62.75	6.00	1.1	3.1172	3.1803	1.020	1.82
	2	0.4976	15		383.195	386.351	3.156	62	64	65	62	63	63.5	5.00	1.1	2.5975	2.6502	1.020	1.81
16	1	0.4449	15.5		386.351	389.168	2.817	62	65	65	63	63	64	5.00	0.9	2.3149	2.3696	1.024	1.85
	2	0.4449	15.5		389.168	392.010	2.842	62	65	65	63	63	64	5.00	0.9	2.3354	2.3696	1.015	1.85
												AVG =		1.015	-0.30	-0.39			
												AVG =		1.015	0.21	0.50			
												AVG =		1.019	0.09	0.39			

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:

The following equations are used to calculate the standard volumes of air passed through the DGM, V_m (std), and the critical orifice, V_{cr} (std), and the DGM calibration factor, Y. These equations are automatically calculated in the spreadsheet above.

$$\text{AVERAGE DRY GAS METER CALIBRATION FACTOR, } Y = \boxed{1.0182}$$

$$\text{INITIAL DRY GAS METER CALIBRATION FACTOR, } Y = 1.0008$$

% DIFFERENCE = 1.74% (Must be <5%)

$$\text{AVERAGE } \Delta H@ = \boxed{1.83}$$

$$(1) \quad Vm_{(std)} = K_1 * Vm * \frac{Pbar + (\Delta H / 13.6)}{Tm} \quad = \text{Net volume of gas sample passed through DGM, corrected to standard conditions}$$

K₁ = 17.64 °R/in. Hg (English), 0.3858 °K/mm Hg (Metric)

T_m = Absolute DGM avg. temperature (°R - English, °K - Metric)

$$(2) \quad Vcr_{(std)} = K' * \frac{Pbar * \Theta}{\sqrt{Tamb}} \quad = \text{Volume of gas sample passed through the critical orifice, corrected to standard conditions}$$

T_{amb} = Absolute ambient temperature (°R - English, °K - Metric)

K' = Average K' factor from Critical Orifice Calibration

$$(3) \quad Y = \frac{Vcr_{(std)}}{Vm_{(std)}} \quad = \text{DGM calibration factor}$$

$$\Delta H@ = \left(\frac{0.750}{Vcr_{(std)}} \right)^2 \Delta H \left(\frac{V_m(\text{std})}{V_m} \right)$$

40 CFR Part 60, Appendix A-1 Method 2 §10.3: Temperature Sensors. After each field use, calibrate thermocouples at a temperature within 10% of the average absolute stack temperature. A reference thermocouple and potentiometer (calibrated against NIST standards) may be used. The absolute temperature measured with the sensor being calibrated and the reference sensor must agree within 1.5%.

Thermocouple Calibration (using NIST-Traceable PIE Model 520 Calibrator)

Reference Value:	250
Console Value:	251
Percent Difference:	0.4%

Acceptance Criteria: ±1.5%

Practical Instrument Electronics													
841 Main Road, Webster, NY 14580 U.S.A. Tel: (585) 872-9350 • Fax: (585) 872-2636													
CERTIFICATE OF CALIBRATION													
<p>This is to certify that your instrument has been calibrated using standards whose accuracies are traceable to the National Institute of Standards and Technology (formerly NBS) within the limits of the NIST Calibration Services. Actual records pertaining to these standards are on file and are available for examination.</p> <p>Certified by: Practical Instrument Electronics Recommended Recalibration: Annually</p> <table border="0"> <tr> <td>Model Number</td> <td>520-K</td> <td>Serial No.</td> <td>S/N 107078</td> </tr> <tr> <td>Calibration Date</td> <td>02-03-09</td> <td>Calibration Technician</td> <td>S. Hall</td> </tr> <tr> <td>In Service Date</td> <td></td> <td>Calibration Due</td> <td></td> </tr> </table>		Model Number	520-K	Serial No.	S/N 107078	Calibration Date	02-03-09	Calibration Technician	S. Hall	In Service Date		Calibration Due	
Model Number	520-K	Serial No.	S/N 107078										
Calibration Date	02-03-09	Calibration Technician	S. Hall										
In Service Date		Calibration Due											

METHOD 5 CRITICAL ORIFICE CALIBRATION



CRITICAL ORIFICE SET S/N: 1531s

DATE: **January 8, 2016**

REFERENCE DRY GAS METER
SERIAL NUMBER: **16309042**
CALIBRATION FACTOR, Yc: **0.991**

LEAK CHECK: **Passed**

ORIFICE #	RUN #	CRITICAL VACUUM (in Hg)	TESTED VACUUM (in Hg)	Barometric Pressure per Orifice AVG (Pa _{bar})		DGM READINGS (ft')		DGM INLET TEMPERATURES °F		DGM OUTLET TEMPERATURES °F		DGM AVG	ELAPSED TIME (MIN)	DGM AH (in H ₂ O)	K' FACTOR (english)	K' FACTOR (metric-liters)	K' FACTOR (metric-m ³)	K' FACTOR VARIATION (%)
				INITIAL	FINAL	NET (V _a)	INITIAL	FINAL	INITIAL	FINAL	INITIAL	FINAL						
31	1	15	17.5	67.132	73.855	6.723	70.9	74.3	74.3	74.5	74.35	74.25	6.00	4.12	0.8535	0.7092	7.0921E-04	-0.04
	2	15	17.5	73.855	80.552	6.727	70.9	74.3	74.1	74.3	74.3	74.25		6.00				
23	1	15	18	80.582	86.457	5.875	71.0	74.2	74.0	74.3	74.3	74.20	7.00	2.29	0.6367	0.5290	5.2903E-04	0.01
	2	15	18	86.457	92.331	5.874	70.9	74.0	73.9	74.3	74.3	74.13		7.00				
18	1	15	18	92.331	97.558	5.257	71.0	74.1	74.1	74.4	74.4	74.25	8.00	1.44	0.4974	0.4133	4.1330E-04	-0.05
	2	15	18	97.558	102.850	5.262	70.9	74.0	74.0	74.4	74.4	74.20		8.00				
16	1	15	18	102.850	108.733	5.883	71.1	74.1	74.1	74.5	74.5	74.30	10.00	1.15	0.4450	0.3698	3.6975E-04	0.03
	2	15	18	108.733	114.613	5.880	71.1	74.1	74.1	74.5	74.5	74.30		10.00				
12	1	15	18	114.613	119.720	5.107	71.1	74.0	73.8	74.5	74.5	74.20	12.00	0.58	0.3215	0.2672	2.6716E-04	-0.06
	2	15	18	119.720	124.833	5.113	71.1	73.8	74.1	74.4	74.5	74.20		12.00				

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:

Calculate the standard volumes of air passed through the DGM and the critical orifices, and calculate the DGM calibration factor, Y, using the equations in US EPA Method 5, Section 7.2.3 (these equations are programmed on the spreadsheet included with each orifice set).

K' = Critical orifice coefficient,

Critical Orifice Set number **1531s** was calibrated in accordance with the Code of Federal Regulations, Title 40, Part 60, Appendix A, Method 5, Section 7.2.

10/08/16
Signature _____
Date _____

[(ft³)°R)^{1/2}]/[(in.Hg)(min.)] - English Units

[(liters)°K]^{1/2}]/[(mm Hg)(min.)] - Metric-Liters Units

[(m³)°K]^{1/2}]/[(mm Hg)(min.)] - Metric Units

RE: Certification of Air Emission Testing Body (AETB) Conformance

To Whom it May Concern:

This letter is to confirm that Emissions Measurement Company LLC ("EMCo") is an Air Emission Testing Body (AETB) operating in conformance with ASTM D7036-04, as required by 40 CFR Part 75, Appendix A §6.1.2. The table below lists the EPA Reference Methods for which each listed Project Manager is a Qualified Individual and other relevant information required by (as applicable) 40 CFR Part 75.59(a)(15), 40 CFR Part 75.59(b)(6) and 40 CFR Part 75.59(d)(4).

Emissions Measurement Company (800) 984-9883					
AETB Qualified Individual Information					
QI Name	QI Email	Exam*	Exam Date	Exam Provider	Provider Email
Andrew Bruning	abruning@stacktest.us	SES Group 1	6/12/2014	SES	QSTIprogram@gmail.com
		SES Group 2	9/18/2015		
Will Stangroom	wstangroom@stacktest.us	SES Group 3	6/12/2015	Ohio-Lumex	andrew.mertz@ohiolumex.com
		EPA Method 30B	1/16/2015*		
Craig Kormylo	ckormylo@stacktest.us	SES Group 1	8/2/2016	SES	QSTIprogram@gmail.com
Matthew Parks	mparks@stacktest.us	SES Group 1	2/5/2016	SES	QSTIprogram@gmail.com
		SES Group 2	9/18/2015		
		SES Group 3	2/5/2016		

*The Source Evaluation Society (SES) Group 1 Exam includes EPA Reference Methods 1, 1A, 2, 2A, 2C, 2D, 2F, 2G, 2H, 3, 3B, 4, 5, 5A, 5B, 5D, 5E, 5F, 5I, 17, 19, 201A and 202. The SES Group 2 Exam includes EPA Reference Methods 1 , 2, 3, 4, 3B, 6, 6A, 6B, 7, 7C, 7D, 8, 11,13A, 13B, 15A, 16A, 19, 26, 26A and 202. The SES Group 3 Exam includes EPA Reference Methods 3A, 6C, 7E, 10, 10B, 20, 25A, 40 CFR Part 60 Performance Specifications 2 – 8, 15 and 40 CFR Part 75. Initial 30B training provided by Ohio-Lumex; refresher exam administered by EMCo once every five years.

Please feel free to contact me with any questions regarding the above.



Matthew Parks
Technical Director